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(54) **PERIPHERAL PEG DRILL COMPONENT**

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**A61C 1/08** (2006.01)

**A61B 17/17** (2006.01)

(52) **U.S. Cl.**

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(58) **Field of Classification Search**

CPC ..... **A61B 17/1684**; **A61B 2017/1778**;  
**A61B 17/1615**; **A61C 1/085**

See application file for complete search history.

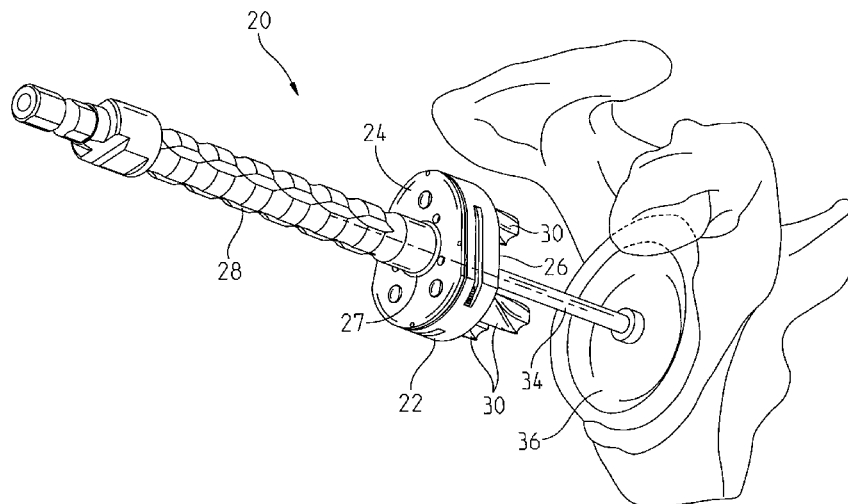
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(57) **ABSTRACT**

A method for simultaneously drilling at least two peripheral peg holes in a bony surface, the method comprising providing a peripheral peg drill component including a housing with a first side, a second side opposite the first side and at least two drill bits extending from the second side of the housing; releasably coupling the first side of the peripheral peg drill component to a drilling device; advancing the peripheral peg drill component over an alignment pin extending from a bony surface until each of the at least two drill bits engage the bony surface; actuating a driving mechanism of the peripheral peg drill component with the drilling device to cause the at least two drill bits to rotate; and simultaneously penetrating the bony surface with the at least two drill bits as they rotate.

**16 Claims, 12 Drawing Sheets**



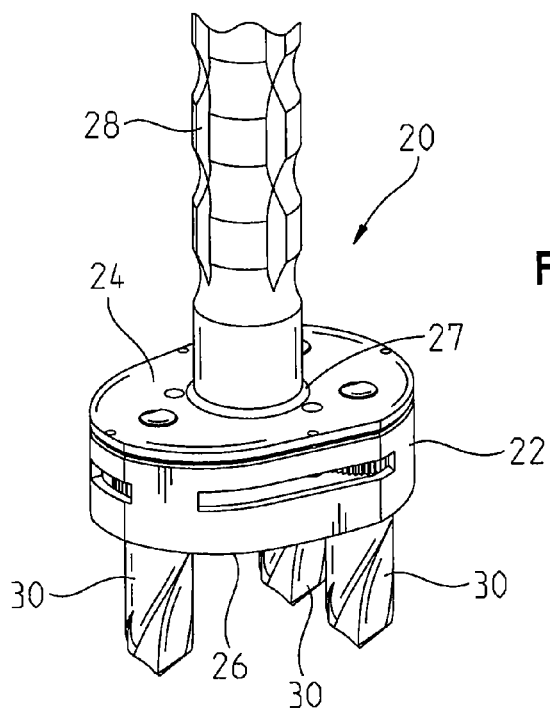


Fig. 1

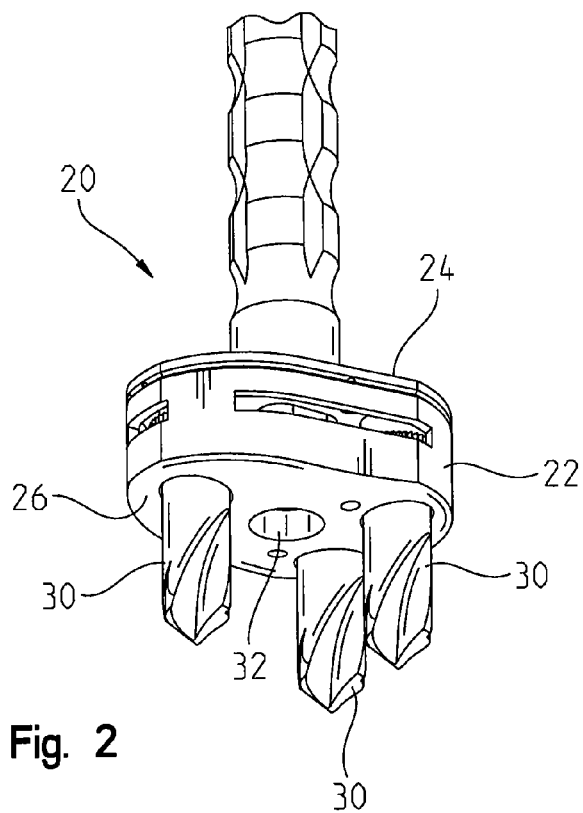


Fig. 2

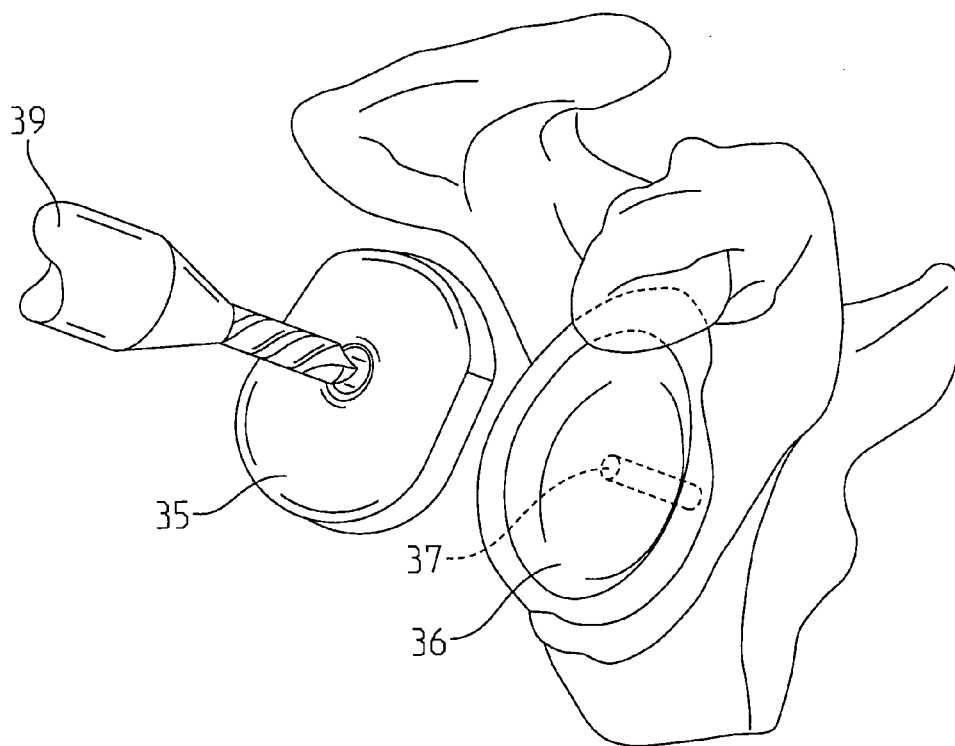


Fig. 3

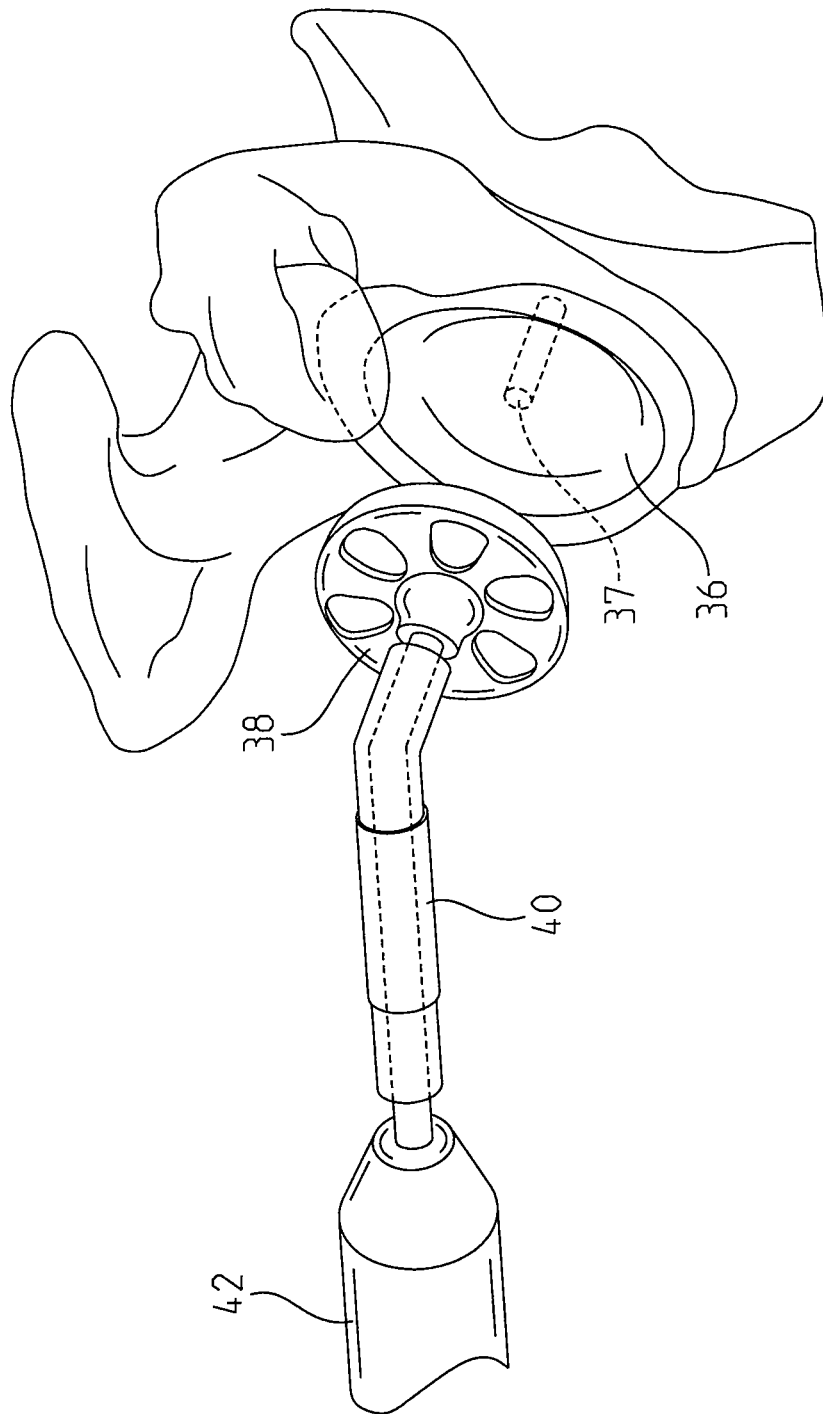


Fig. 4

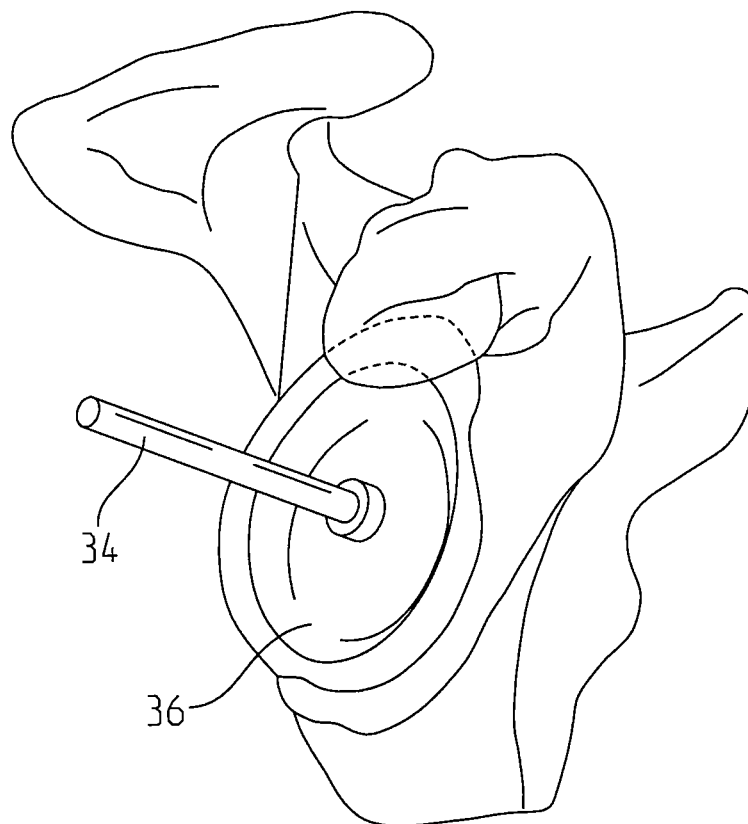


Fig. 5

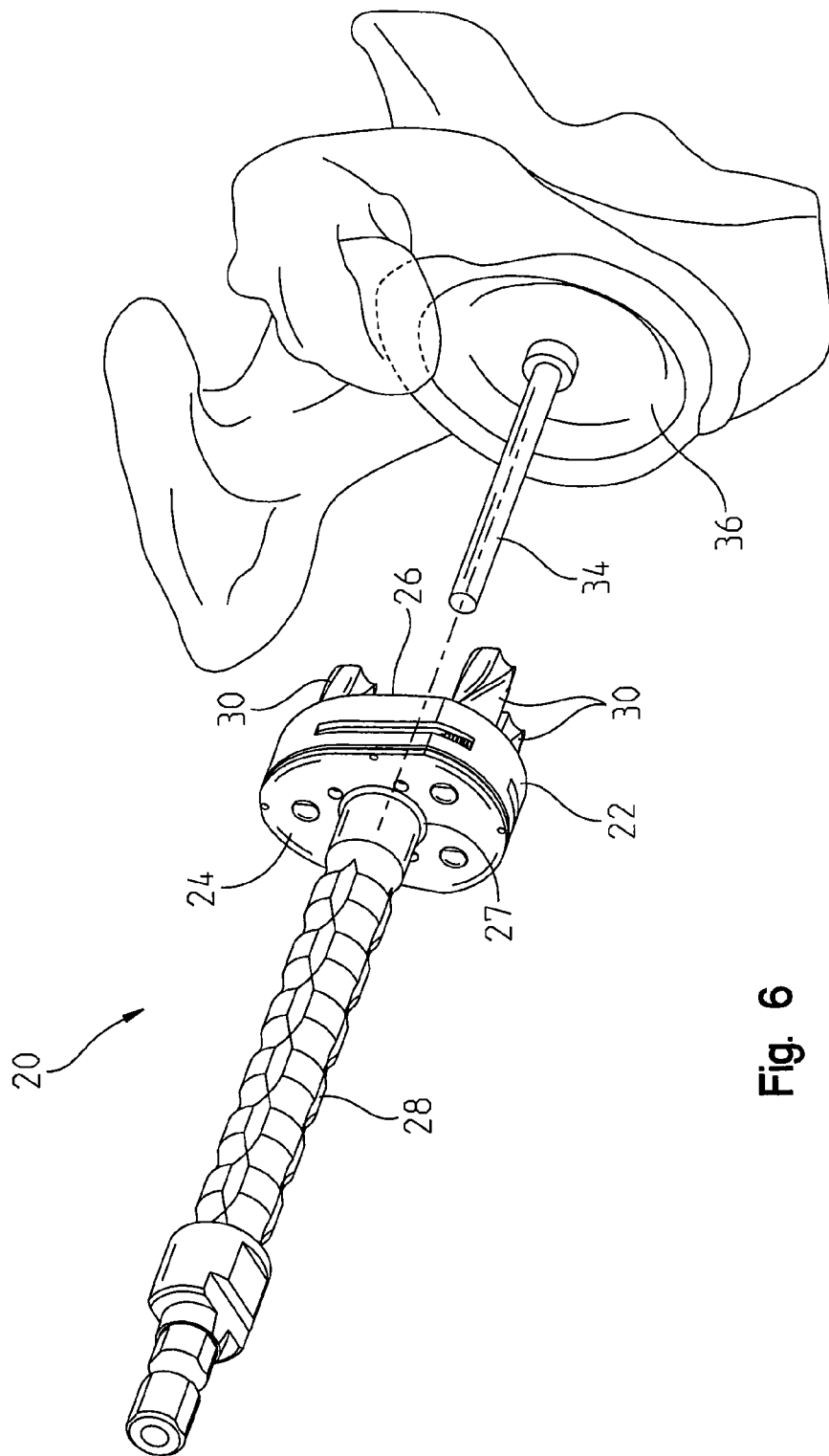


Fig. 6

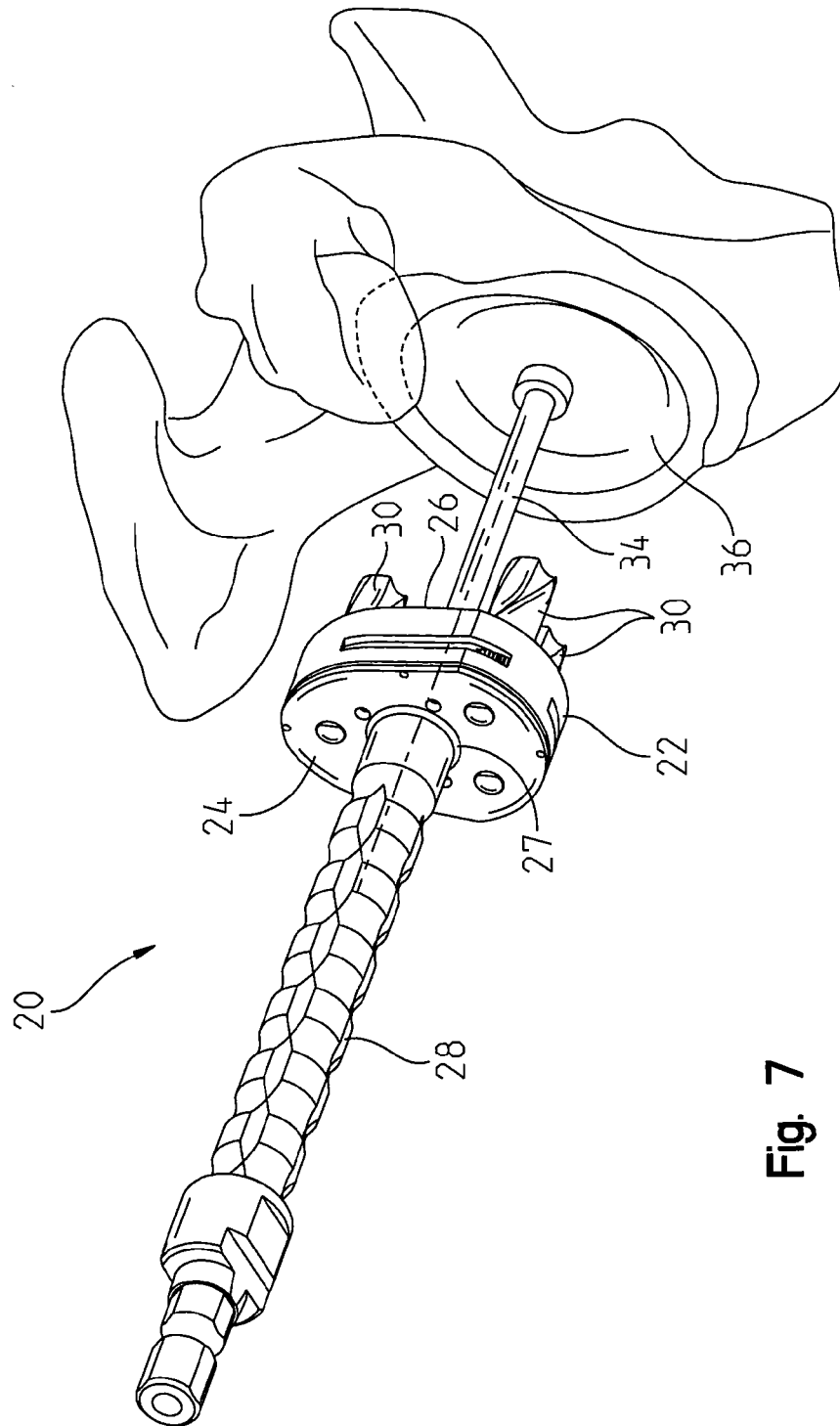


Fig. 7

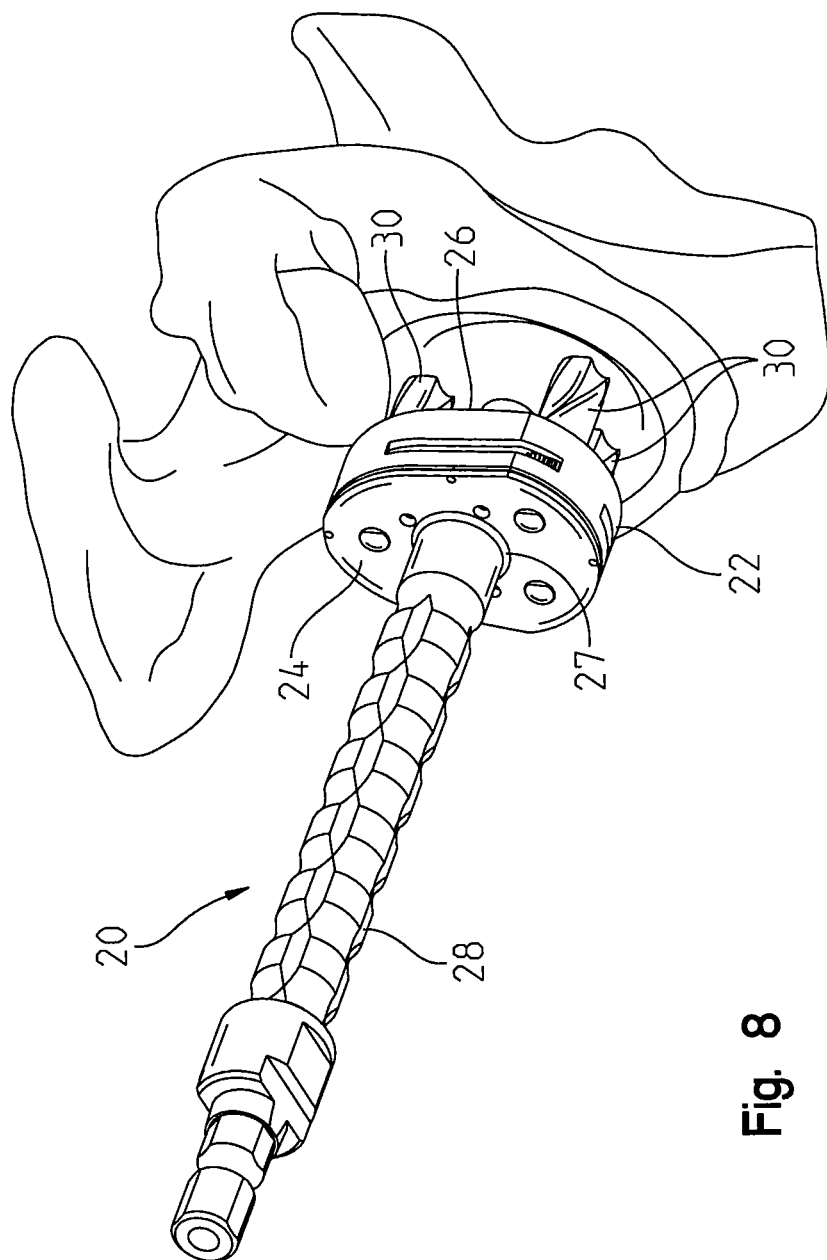


Fig. 8

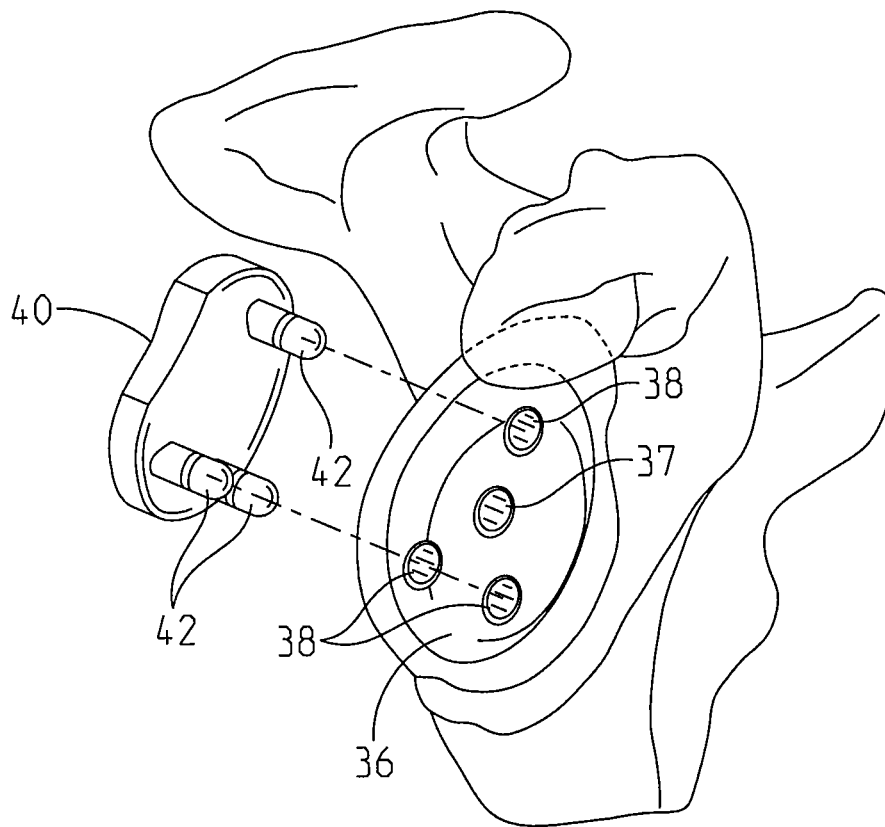


Fig. 9

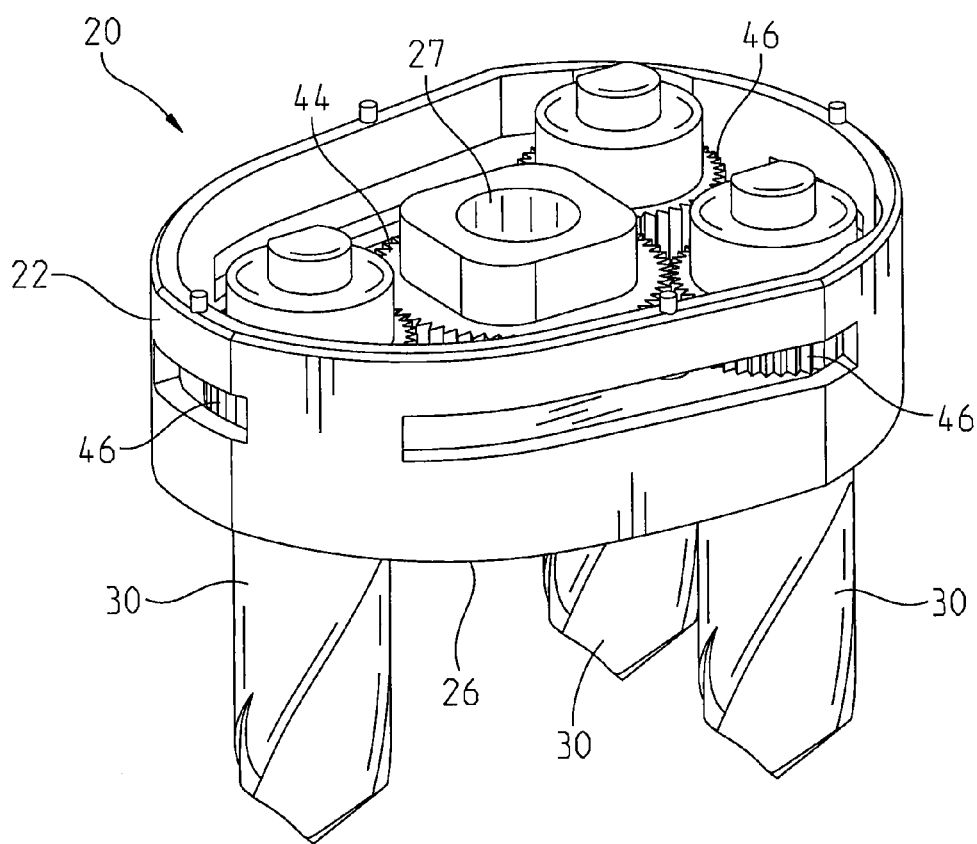


Fig. 10

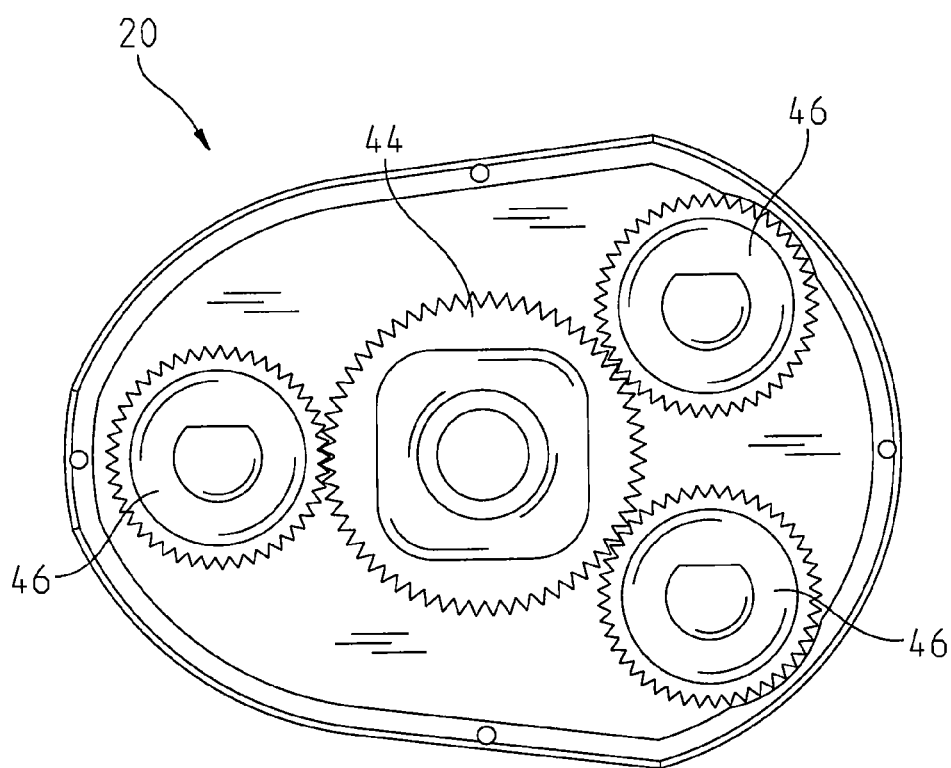


Fig. 11

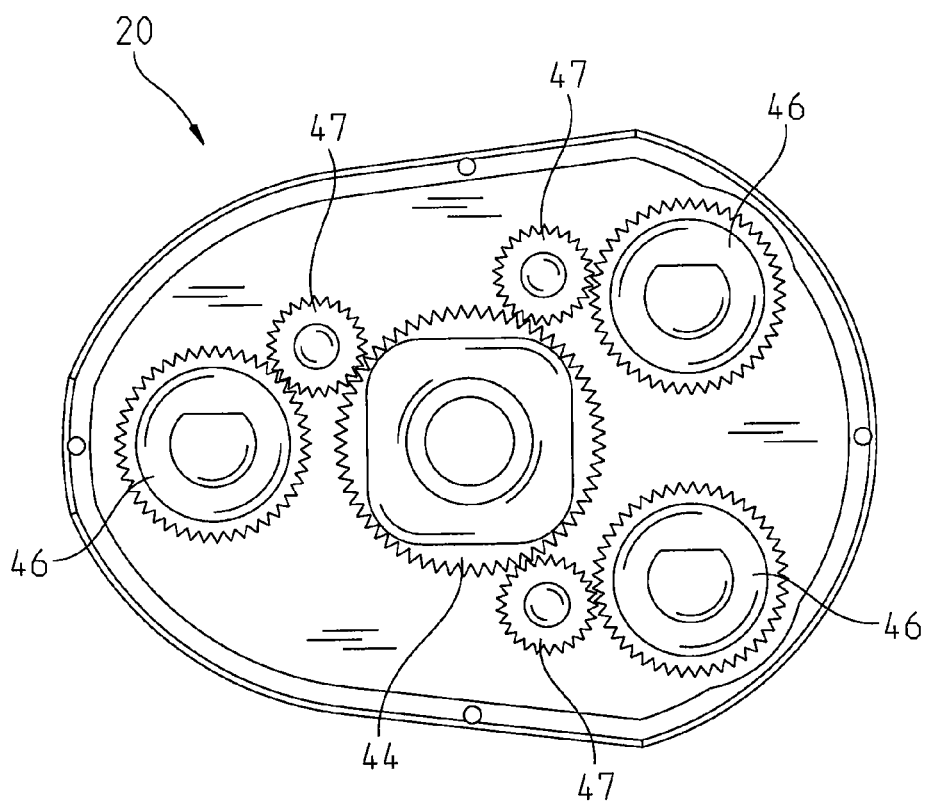


Fig. 12

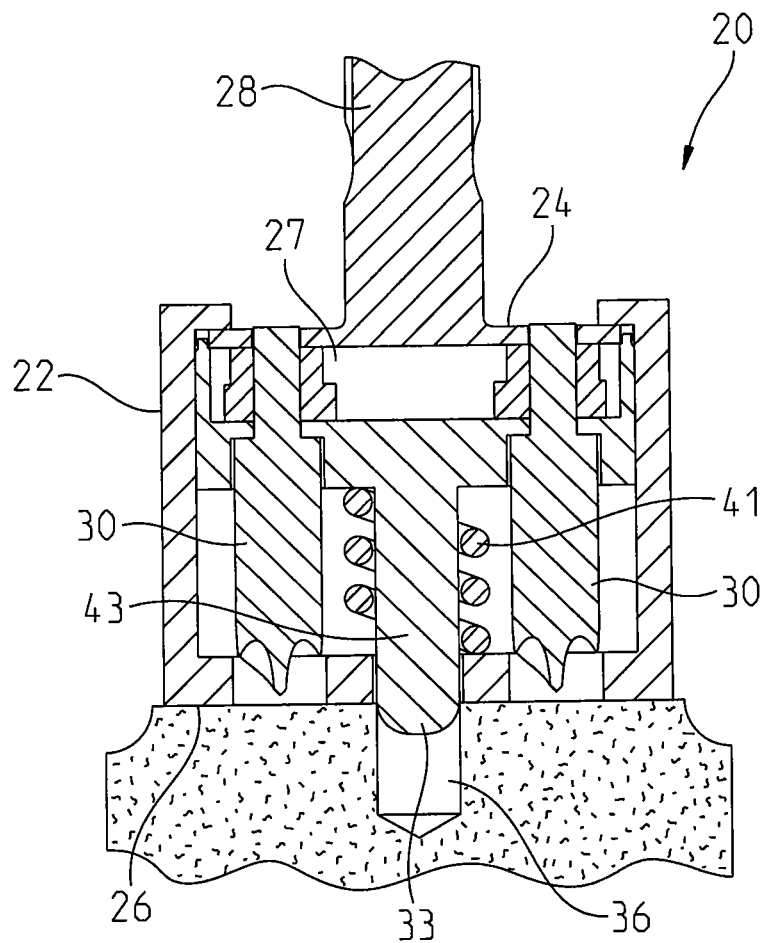


Fig. 13

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**PERIPHERAL PEG DRILL COMPONENT****CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a continuation of U.S. patent application Ser. No. 13/472,738 filed May 16, 2012, and entitled "Peripheral Peg Drill Component," the disclosure of which is expressly incorporated in its entirety herein by this reference.

**TECHNICAL FIELD**

The present disclosure generally relates to a surgical drill component, and more particularly, a peripheral peg drill component that can be used as part of a glenoid replacement surgical procedure.

**BACKGROUND OF THE DISCLOSURE**

The statements in this section merely provide background information related to the present disclosure and should not be construed as constituting prior art.

A natural shoulder joint may undergo degenerative changes due to a variety of etiologies. When these degenerative changes become so far advanced and irreversible, it may ultimately become necessary to replace a natural shoulder joint with a prosthetic shoulder joint. When implantation of a shoulder joint prosthesis becomes necessary, the natural head portion of the humerus can be resected and a cavity created in the intramedullary canal of the host humerus for accepting a humeral component. Moreover, the glenoid cavity positioned at the lateral edge of the scapula may also be resurfaced and shaped to accept the glenoid component. The humeral component includes a head portion used to replace the natural head of the humerus, while the glenoid component generally includes an articulating surface which is engaged by the head portion of the humeral component.

It is generally known in the art to provide a shoulder joint prosthesis having a glenoid component, as discussed above. Current glenoid replacement surgical techniques, however, suffer from some disadvantages, particularly as they require the surgeon to perform numerous bone preparation steps before the glenoid component can be surgically implanted. More particularly, since glenoid components are subject to various types of loading by the head portion of the humeral component, the glenoid component must offer a stable and secure articulating surface. To achieve this, some glenoid components provide peripheral pegs which are inserted and cemented into holes bored into the glenoid cavity. Some of the pegged glenoid components utilize up to five peripheral pegs in order to stabilize and secure the glenoid component to the scapula. Current glenoid replacement procedures require pre-drilled holes to be formed in the bone for each peripheral peg of the glenoid component. To achieve this, typically a guide is placed on the glenoid that provides a path for each peripheral peg hole to be drilled. After each hole is drilled, an anti-rotation peg is inserted into that respective hole of the guide to ensure the next drilled hole is properly aligned. By requiring multiple holes to be separately drilled into the bone, not only is the process time-consuming, but it also increases the possibility that a drilling misalignment will occur during the bone preparation process.

What is needed then is a device that can be incorporated into a glenoid replacement surgical technique without suffering from the above-mentioned disadvantages. The present

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disclosure is intended to improve upon and resolve some of these known deficiencies of the art.

**SUMMARY OF THE DISCLOSURE**

In accordance with one aspect of the present disclosure, a method for simultaneously drilling at least two peripheral peg holes in a bony surface is provided. According to this illustrative embodiment, the method comprises the steps of: providing a peripheral peg drill component including a housing with a first side, a second side opposite the first side and at least two drill bits extending from the second side of the housing; releasably coupling the first side of the peripheral peg drill component to a drilling device; advancing the peripheral peg drill component over an alignment pin extending from a bony surface until each of the at least two drill bits engage the bony surface; actuating a driving mechanism of the peripheral peg drill component with the drilling device to cause the at least two drill bits to rotate; and simultaneously penetrating the bony surface with the at least two drill bits as they rotate.

In accordance with another aspect of the present disclosure, a peripheral peg drill component is provided and comprises a housing having a first side and a second side substantially parallel to the first side, the first and second sides of the housing being connected by a passageway; at least two drill bits extending from the second side of the housing; a driving mechanism within the housing, the driving mechanism being configured to rotate the at least two drill bits and cause them to simultaneously penetrate a bony surface; a drive shaft connection port extending above the first side of the housing, the connection port having a central through hole; and an aperture for receiving an alignment pin extending from the bony surface, the aperture being centrally positioned on the second side of the housing between the at least two drill bits. In accordance with this embodiment, the passageway, the central through hole and the aperture together create a common through hole that is positioned along a central axis of the housing.

Still other objects and benefits of the disclosure will become apparent from the following written description along with the accompanying figures.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The above-mentioned aspects of the present disclosure and the manner of obtaining them will become more apparent and the disclosure itself will be better understood by reference to the following description of the embodiments of the disclosure taken in conjunction with the accompanying drawings, wherein:

FIG. 1 represents a perspective view of a peripheral peg drill component according to the present teachings;

FIG. 2 represents a perspective bottom view of the peripheral peg drill component of FIG. 1;

FIGS. 3-5 represent perspective views of a glenoid cavity being prepared prior to the implantation of a glenoid component according to the present teachings;

FIGS. 6-7 represent perspective views of a peripheral peg drill component in accordance with the present teachings being advanced along a guide pin prior to peripheral peg holes being drilled into a glenoid;

FIG. 8 represents a perspective view of a peripheral peg drill component drilling peripheral peg holes into a glenoid in accordance with the present teachings;

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FIG. 9 represents a perspective view of a glenoid pegged component aligned for insertion into the drilled peripheral peg holes of the glenoid according to the present teachings;

FIG. 10 represents a perspective view of a peripheral peg drill component having its top cover removed to reveal the internal driving mechanism in accordance with the present teachings;

FIG. 11 represents a top view of a peripheral peg drill component having its top cover removed to reveal a spur gear system for driving the peripheral peg drill component according to the present teachings;

FIG. 12 represents a top view of a peripheral peg drill component having its top cover removed to reveal another spur gear system for driving the peripheral peg drill component according to the present teachings; and

FIG. 13 represents a cross-sectional view of a collapsible peripheral peg drill component according to the present teachings.

Corresponding reference characters indicate corresponding parts throughout the several views. Although the exemplification set out herein illustrates embodiments of the disclosure, in several forms, the embodiments disclosed below are not intended to be exhaustive or to be construed as limiting the scope of the disclosure to the precise forms disclosed.

#### DETAILED DESCRIPTION

The embodiments of the present disclosure described below are not intended to be exhaustive or to limit the disclosure to the precise forms disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art may appreciate and understand the principles and practices of the present disclosure.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. Although any method and materials similar or equivalent to those described herein can be used in the practice or testing of the present disclosure, the specific methods and materials are now described. Moreover, the techniques employed or contemplated herein are standard methodologies well known to one of ordinary skill in the art and the materials, methods and examples are illustrative only and not intended to be limiting.

Referring generally to FIGS. 1 and 2, perspective views of a peripheral peg drill component 20 according to the teachings of the present application are shown. The peripheral peg drill component 20 is defined by a housing 22 having a first side 24 and a second side 26. The first side 24 of the housing 22 includes a defined opening 27 that is configured to receive the drive shaft 28 of a drill, while the second side 26 has one or more drill bits 30 extending therefrom and configured to create peripheral peg holes in a glenoid cavity upon actuation of the drilling device. In terms of the structural means by which the drive shaft 28 is connected to the housing 22 of the peripheral peg drill component 20, it should be understood and appreciated herein that any known connection means may be utilized without straying from the teachings and scope of the present application. For instance, in accordance with one specific illustrative embodiment, a conventional Hudson connection can be utilized. In accordance with yet other illustrative embodiments, the drive shaft can be releasably secured to the peripheral peg drill component 20 by a connection means including, but not limited to, a square-drive quick-connection, a conventional

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drill chuck mechanism, a set screw, a tool clamp, a rivet, a snap ring, a press-fit, or the like. As such, the present teachings are not intended to be limited herein.

As is particularly shown in FIG. 2, the second side 26 of the peripheral peg drill component 20 includes a substantially centralized and defined opening 32 that is configured to receive a guide or alignment pin 34 (see FIG. 5) that has been inserted into the glenoid cavity 36 as part of the glenoid preparation process. As will be explained in more detail below, in accordance with certain alternative aspects of the present disclosure (see FIG. 13), it should be understood and appreciated that instead of having a defined opening 32, the housing 22 can alternatively have a movable centralized boss 33 that is configured to move from a first position within the housing 22 to a second position outside of the housing 22. In accordance with this embodiment, the centralized boss 33 can have a geometry that substantially matches the geometry of the pre-reamed glenoid cavity 36 to thereby ensure proper alignment and orientation of the drill component within the glenoid cavity when it is extended outside of the housing 22.

FIGS. 3-5 represent an illustration of an exemplary process for preparing a glenoid prior to implanting a glenoid component according to the teachings of the present application. As shown in FIG. 3, a drilling guide 35 can be used to create a central guide hole 37 into the surface of the glenoid cavity 36 using a drill 39. After the preparation of a central guide hole 37, as shown in FIG. 4, the glenoid cavity 36 is reamed using a glenoid surface rasp 38 and an angled reamer shaft 40 with driver 42. As those of skill in the art will understand and appreciate, the glenoid surface rasp 38 is configured to prepare a planar or curved glenoid surface to mate with the coupling side of the glenoid component to be implanted. To accomplish this, the glenoid surface rasp 38 may include a roughened spherical surface that substantially corresponds to the spherical shape of the medial surface of the glenoid component.

Once the surface of the glenoid cavity has been prepared, conventional surgical glenoid replacement processes typically require that a plurality of fixed glenoid peg accepting holes be individually drilled into the resected glenoid. To accomplish this, a drilling guide is placed on the glenoid and is used as a template to provide a path for each peripheral peg hole to be drilled. After each hole is drilled, an anti-rotation peg is inserted into that respective hole of the guide to ensure the next drilled hole is properly aligned.

The present teachings, however, eliminate the need to drill each hole individually, and instead provide a means for drilling all peripheral peg holes at once. To achieve this, as shown in FIG. 5, a guide or alignment pin 34 is placed in the central guide hole 37 of the glenoid cavity 36 and is configured to penetrate the defined opening 32 positioned on of the second side 26 of the housing 22. In other words, and with reference to FIGS. 6-7, the defined opening 32 on the second side 26 of the peripheral peg drill component 20 is aligned with and advanced along the guide pin 34 until the peripheral peg drill bits 30 engage the surface of the glenoid cavity 36. After the peripheral peg drill bits 30 engage the glenoid cavity 36, the drill can be activated, thereby allowing all peripheral peg holes to be created simultaneously at once (see FIG. 8). The material from which the peripheral peg drill bits 30 are made depends on the intended application of the drill bit. For orthopedic uses, however, the drill bits 30 can be manufactured from any surgical quality metallic component including, but not limited to, stainless steel, titanium, aluminum, brass, cobalt chrome molybdenum alloys, nitinol alloys and the like. It should also be

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understood and appreciated herein that the size, orientation and number of drill bits **30** (and/or their respective flutes) can be adjusted as necessary, particularly depending on the intended application and use of the drill bits. In accordance with one specific embodiment, the peripheral peg drill component **20** has at least two drill bits **30** extending from the second side **26** of the housing **22**, while in accordance with still other specific embodiments, at least three drill bits **30** extend from the second side **26**. As such, the present teachings are not intended to be limited herein.

As shown in FIG. 9, after the peripheral peg holes **38** are created, a glenoid component **40** can be implanted into the resected glenoid cavity **36** by aligning the peripheral pegs **42** of the glenoid component **40** with the drilled peripheral peg holes **38**. It should be understood and appreciated herein that the teachings of the present application can be performed using various different geometrical peg configurations and shapes. For instance, while the present application depicts an illustrative embodiment in which the glenoid component **40** has three peripheral pegs **42**, it is of course possible to perform the teachings of the present application using less or more than three peripheral pegs if desired. While not shown here, it is also envisioned that bone cement and/or various appropriate biological materials can be injected into the peripheral peg holes **38** defined within the glenoid cavity **36** before the peripheral pegs **42** of the glenoid component **40** are implanted to facilitate bonding of the component to the bone if desired. Those of skill in the art will understand how to incorporate such materials into the implantation system if necessary; therefore, a detailed discussion of the bonding process is not discussed in detail herein.

It should be understood and appreciated herein that various means can be used to drive the peripheral peg drill bits **30** so that the peripheral peg holes **38** are created in the glenoid cavity **36**. FIGS. 10-12, for instance, depict two illustrative means for driving the drill bits **30** of the peripheral peg drill component **20** by using spur gear systems. Specifically, FIGS. 10 and 11 illustrate a standard spur gear system. Spur gear systems are generally known in the art and include various configurations of gear wheels, each having projections (teeth) that are configured to intersect or mesh with the teeth of another gear wheel, thereby transmitting force and motion alternatively from one gear to another. As is shown in this illustrative embodiment, a drive gear **44** is connected to three driven gears **46**, each of which are connected to and configured to drive one of the corresponding peripheral peg drill bits **30** extending from the second side **26** of the housing **22**. When a drill connected to the drive shaft **28** is activated, the drive shaft **28** will cause the drive gear **44** to rotate. Because the three driven gears **46** have teeth meshing with the teeth of the drive gear **44**, the driven gears **46** will be caused to rotate in the opposite direction of the drive gear **44** as it rotates. Despite rotating in the opposite direction from the drive gear **44**, each of the three driven gears **46** will still rotate in the same direction as one another, and in turn, will cause their corresponding peripheral peg drill bits **30** of which they are individually associated to rotate in the same direction in unison as well. In accordance with certain variations of this illustrative embodiment, it is also possible to have more than one gear stacked on top of one another, such that each gear has a different diameter for mating up with a gear on each peripheral drill bit **30**. Such an arrangement would allow for non-symmetrical drill locations. Moreover, in accordance with certain aspects of the present disclosure, the internal drive mechanism can be designed in such a manner as to create counter-clockwise turning of the drill bits to accom-

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modate left hand cutting procedures. Accordingly, the present teachings are not intended to be limited herein.

As is shown in FIG. 12, in accordance with other illustrative embodiments of the present disclosure, the spur gear system used for driving the drill bits **30** of the peripheral peg drill component **20** can also include additional intermediary idler gears **47** positioned between each of the driven gears **46** and the drive gear **44**. As those of skill in the art will understand and appreciate, the addition of idler gears **47** can be used to keep the directional rotation of the driven gears **46** and the drive gear **44** to stay the same as the drive shaft.

As is briefly mentioned above and with illustrative reference to FIG. 13, in accordance with certain aspects of the present disclosure, the second side **26** of the peripheral peg drill component can be configured to include a movable centralized boss **33** that can transition between a first position within the housing **22** to a second position outside of the housing **22**. The centralized boss **33** can also have a geometry that substantially matches the geometry of the pre-reamed glenoid cavity **36** such that a conformed surface mating occurs when the centralized boss **33** is extended into the reamed glenoid cavity **36**. In accordance with certain embodiments, and to help control the orientation of the peripheral peg drill bits **30** relative to the pre-reamed glenoid and the central boss geometry, the centralized boss **33** and/or the peripheral drill bits **30** can be collapsible within the housing **22**. In accordance with such embodiments, the collapsibility of the centralized boss **33** and/or the drill bits **30** make it easier to center the drill component **20** on the surface of the pre-reamed glenoid cavity **36** before the peripheral peg drill bits **30** engage bone.

It should be understood and appreciated herein that there are numerous ways to accomplish the collapsibility of the centralized boss **33** and/or the drill bits **30** within the housing **22**. For instance, as shown in FIG. 13, a compression spring **41** can be disposed on a shaft **43** of the centralized boss **33** such that when the centralized boss **33** is advanced into glenoid cavity **36** as the second side **26** of the drill component contacts bone, the spring **41** compresses, and in turn causes the peripheral peg drill bits **30** to collectively extend out from the housing **22** as a single unit. In accordance with yet other embodiments, however, it is envisioned that each peripheral peg drill bit **30** can have its own compression spring, whereby each drill bit **30** is able to individually extend out of the housing in response to contact with the bone surface. Such an arrangement would be particularly useful for situations in which the surface of glenoid cavity **36** is uneven and requires the drill bits **30** to retract at different levels in order to achieve a proper surface alignment of the drill component within the glenoid cavity.

While an exemplary embodiment incorporating the principles of the present disclosure has been disclosed hereinabove, the present disclosure is not limited to the disclosed embodiments. Instead, this application is intended to cover any variations, uses, or adaptations of the disclosure using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this disclosure pertains and which fall within the limits of the appended claims.

The terminology used herein is for the purpose of describing particular illustrative embodiments only and is not intended to be limiting. As used herein, the singular forms "a", "an" and "the" may be intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms "comprises," "comprising," "including," and "having," are inclusive and therefore specify the presence of

stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The method steps, processes, and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed.

When an element or layer is referred to as being “on”, “engaged to”, “connected to” or “coupled to” another element or layer, it may be directly on, engaged, connected or coupled to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being “directly on”, “directly engaged to”, “directly connected to” or “directly coupled to” another element or layer, there may be no intervening elements or layers present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., “between” versus “directly between,” “adjacent” versus “directly adjacent,” etc.). As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

Although the terms first, second, third, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms may be only used to distinguish one element, component, region, layer or section from another region, layer or section. Terms such as “first,” “second,” and other numerical terms when used herein do not imply a sequence or order unless clearly indicated by the context. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the example embodiments.

Spatially relative terms, such as “inner,” “outer,” “beneath”, “below”, “lower”, “above”, “upper” and the like, may be used herein for ease of description to describe one element or feature’s relationship to another element(s) or feature(s) as illustrated in the figures. Spatially relative terms may be intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as “below” or “beneath” other elements or features would then be oriented “above” the other elements or features. Thus, the example term “below” can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations).

What is claimed is:

1. A method for simultaneously drilling at least two peripheral peg holes in a bony surface, the method comprising:

providing a peripheral peg drill component including a housing with a first side, a second side opposite the first side and at least two drill bits extending from the second side of the housing;

releasably coupling the first side of the peripheral peg drill component to a drilling device;

advancing the peripheral peg drill component over an alignment pin extending from a bony surface until each of the at least two drill bits engage the bony surface;

actuating a driving mechanism of the peripheral peg drill component with the drilling device to cause the at least two drill bits to rotate; and

simultaneously penetrating the bony surface with the at least two drill bits as they rotate.

2. The method of claim 1, wherein the step of actuating the driving mechanism comprises actuating a spur gear system located inside of the housing, the spur gear system having a drive gear and at least two driven gears.

3. The method of claim 1, wherein the step of actuating the driving mechanism comprises actuating a spur gear system located inside of the housing, the spur gear system having a drive gear, at least two driven gears, and at least two idler gears, each idler gear of which is positioned between the drive gear and one of the at least two driven gears.

4. The method of claim 1, further comprising the step of collapsing the at least two drill bits into the housing as the bony surface is engaged.

5. The method of claim 1, wherein the step of advancing the alignment pin comprises advancing a movable boss over the alignment pin, the movable boss further having a compression spring that is configured to assist with moving the boss from a first position located within the housing to a second position located outside of the housing.

6. The method of claim 1, wherein the step of advancing the peripheral peg drill component over an alignment pin comprises advancing the alignment pin through an opening on the second side of the housing.

7. A peripheral peg drill component, comprising:

a housing having a first side and a second side substantially parallel to the first side, the first and second sides of the housing being connected by a passageway;

at least two drill bits extending from the second side of the housing;

a driving mechanism within the housing, the driving mechanism being configured to rotate the at least two drill bits and cause them to simultaneously penetrate a bony surface;

a drive shaft connection port extending above the first side of the housing, the connection port having a central through hole; and

an aperture for receiving an alignment pin extending from the bony surface, the aperture being centrally positioned on the second side of the housing between the at least two drill bits;

wherein the passageway, the central through hole and the aperture together create a common through hole that is positioned along a central axis of the housing.

8. The peripheral peg drill component of claim 7, further comprising a drive shaft releasably coupled to the drive shaft connection port, the drive shaft being connectable to a drill and configured to actuate the driving mechanism in response to the drill.

9. The peripheral peg drill component of claim 7, wherein the driving mechanism is a spur gear system having a drive gear and at least two driven gears.

10. The peripheral peg drill component of claim 9, wherein the at least two driven gears are each independently associated with and configured to simultaneously rotate in the same direction as one of the at least two drill bits.

11. The peripheral peg drill component of claim 7, wherein the driving mechanism is a spur gear system having a drive gear, at least two driven gears and at least two idler gears, each idler gear of which is positioned between the drive gear and one of the at least two driven gears.

12. The peripheral peg drill component of claim 11, wherein the at least two driven gears are each independently associated with and configured to simultaneously rotate in the same direction as one of the at least two drill bits.

13. The peripheral peg drill component of claim 7, wherein the at least two drill bits are configured to collapse into the housing as the bony surface is engaged.

14. The peripheral peg drill component of claim 7, further comprising a movable boss associated with the second side 5 of the housing, the movable boss being configured to receive the alignment pin extending from a bony surface.

15. The peripheral peg drill component of claim 14, wherein the movable boss further comprises a compression spring that is configured to assist with moving the boss from 10 a first position within the housing to a second position outside of the housing.

16. The peripheral peg drill component of claim 14, wherein the movable boss is configured to unitarily collapse 15 the at least two drill bits into the housing as the bony surface is engaged.

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